Overview of New Extreme Heat Projections for California

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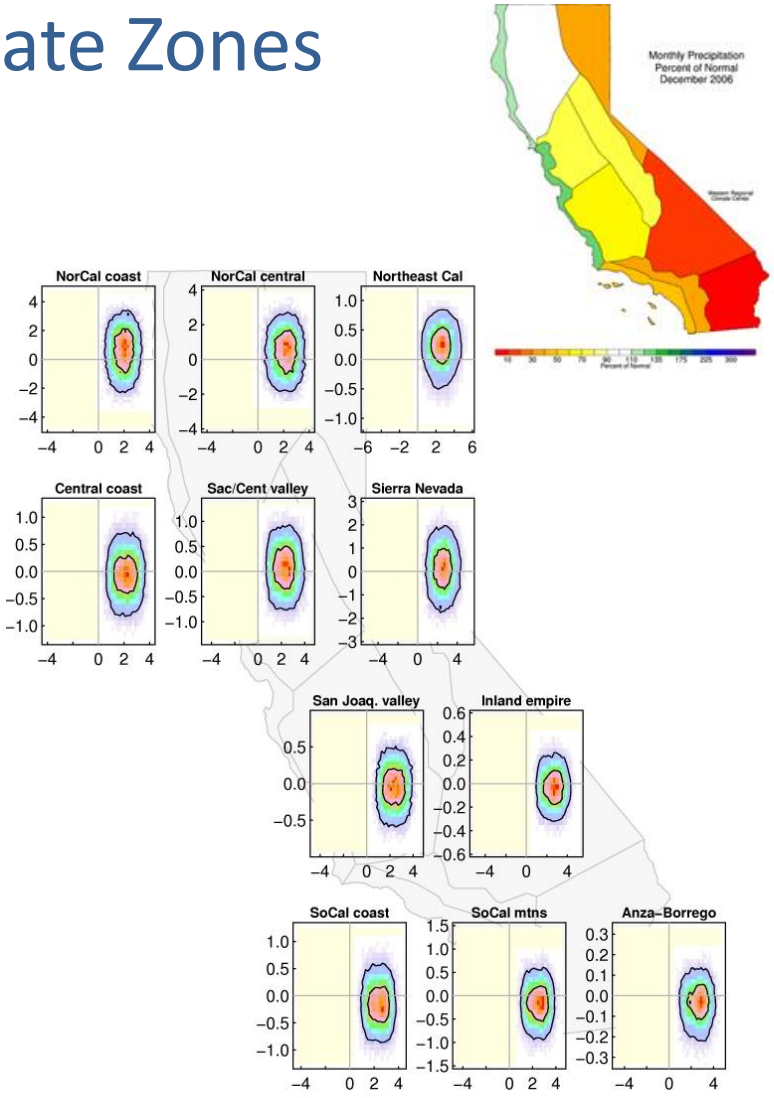
Outline

- **Probabilistic Projections for California Climate Zones**: Regional variations and commonalities in temperature and precipitation
- **Next-Generation Model Results** (pending): What's coming?
- Projected Regional **High- and Low- Temperature Extremes**
- **Timing, Frequency, and Intensity of Heat Waves**: Regionally Downscaled Projections as Represented by Cal-Adapt's Extreme Heat Tool

Probabilistic Projections for California Climate Zones

- "Probabilistic" climate projections for CA have been created using multiple global climate models and downscaling techniques
- Models predict warming throughout the state *(rightward shift for all regions)*
- Very wide range of uncertainty with regard to whether precipitation will increase or decrease *(not certain what will happen)*

PRIOR GENERATION OF GLOBAL CLIMATE MODELS



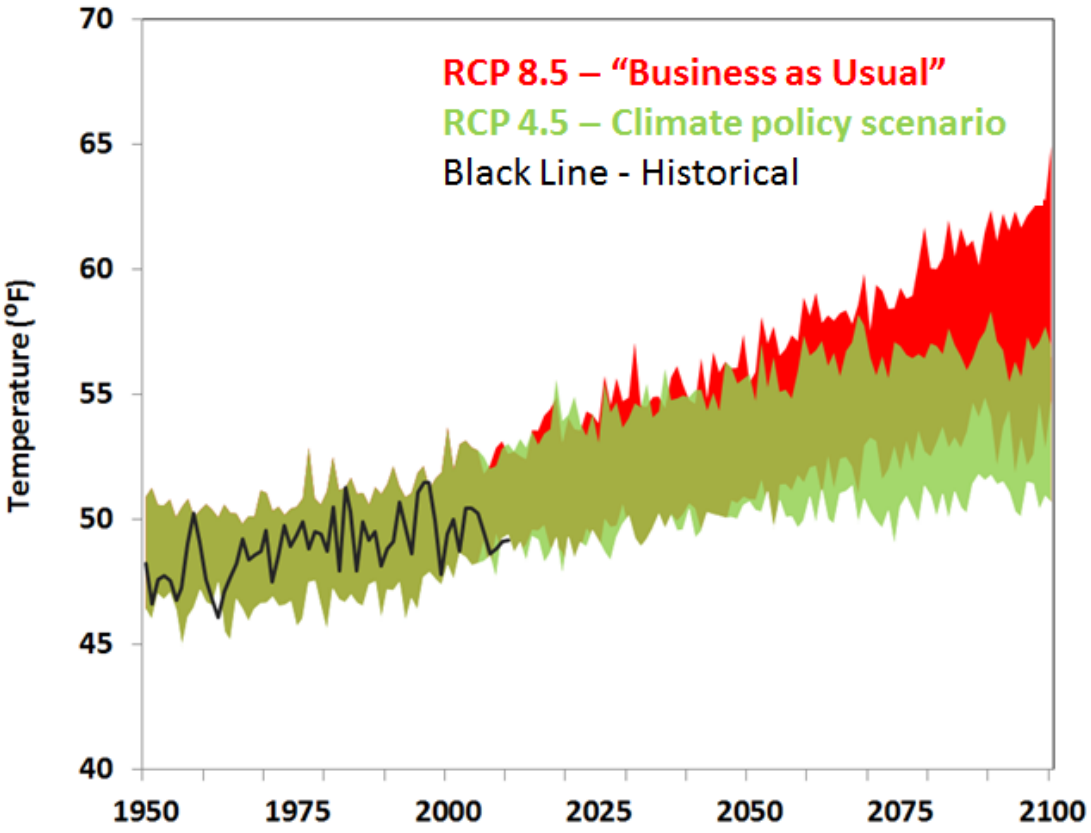
Joint distributions of change in temperature (deg C, x axis) and precipitation (mm/day, y axis) in DJF. Outer ellipse encloses 95% of the data; inner encloses 50%.

Pierce, D.W., et al., 2013: Probabilistic estimates of future changes in California temperature and precipitation using statistical and dynamical downscaling. Climate Dynamics, 40, 839-856. doi:10.1007/s00382-012-1337-9.

Next-Generation Model Results Using LOCA

- Increased spatial resolution (*important for resolving community-level impacts*)
- After year 2005, the green and red areas show projections.
- Very little difference in envelopes of variability associated with mid- and high-emissions trajectories before 2050.

Annual average temperature for grid cell near SMF



Source: Franco and Oliver using data provided by David Pierce (Scripps)

Heat Waves: Expect them to be Worse

For highest three-day average temperature:

- **Temperatures get higher** (*illustrated as rightward shift of projected (blue) distribution relative to historical (red)*)
- **Extreme high temperatures show disproportionate shift for inland areas, including Sierra Nevada, Inland Empire** (*shown as increasing distance between historical and projected temperature for highs*)

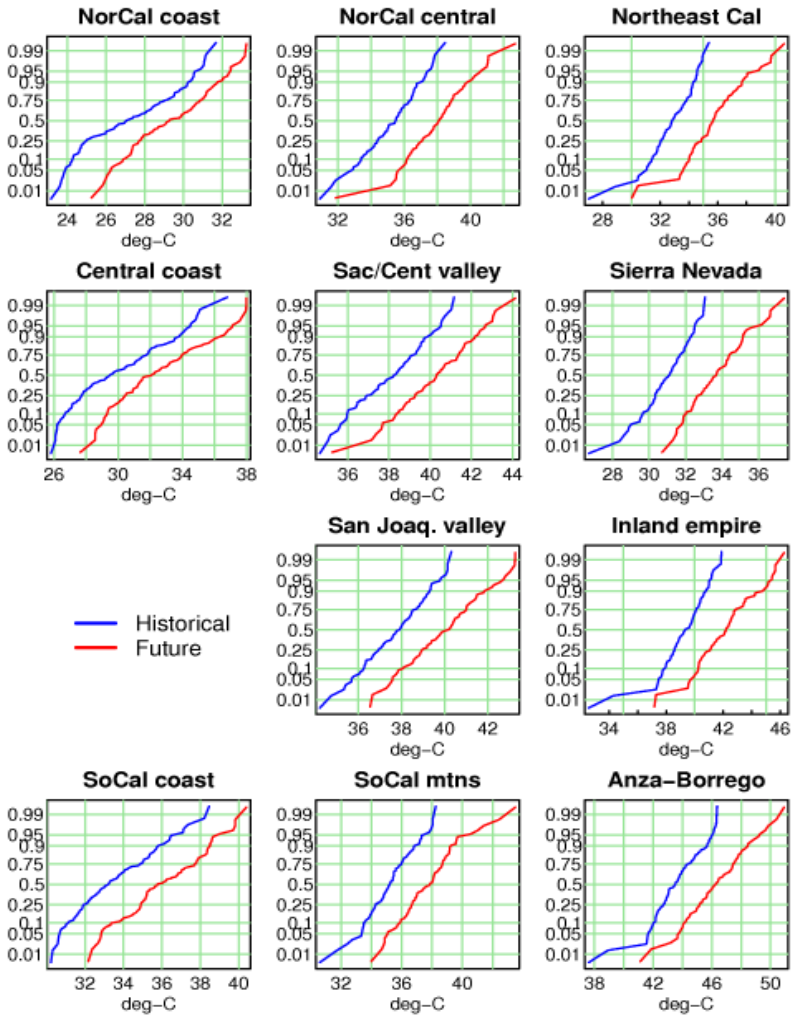
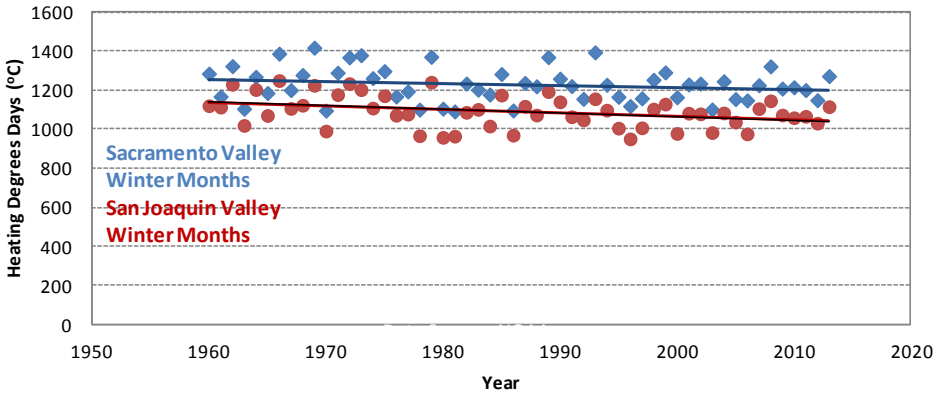


Figure: Cumulative distribution functions of the highest 3-day average temperature in the year.

Pierce, D.W., et al. , 2013. *Climate Dynamics*, **40**, 839-856. doi:10.1007/s00382-012-1337-9.

Cold Snaps Persist

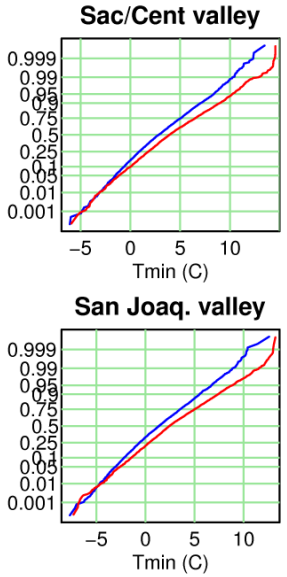
- Heating Degree Days* decreasing in the Central Valley, according to NOAA
- Recent research finds a trend of decreasing winter fog in the Central Valley (Baldocci and Waller 2014, *Geophys Res. Letters*)
  - Clear nights can result in very low temperatures
- Even with warming trends, cold snaps would not disappear (2050 projections)



" Winter fog is decreasing in the fruit growing region of the Central Valley of California "

NASA

2050



* Heating Degree Days are a measure of the degree and duration of cool weather

Figure: Cumulative Distribution Functions of January Daily Minimum Temperatures (Tmin) in Sacramento & San Joaquin Valleys. Note that low-end extremes are expected to persist in the face of climate change.

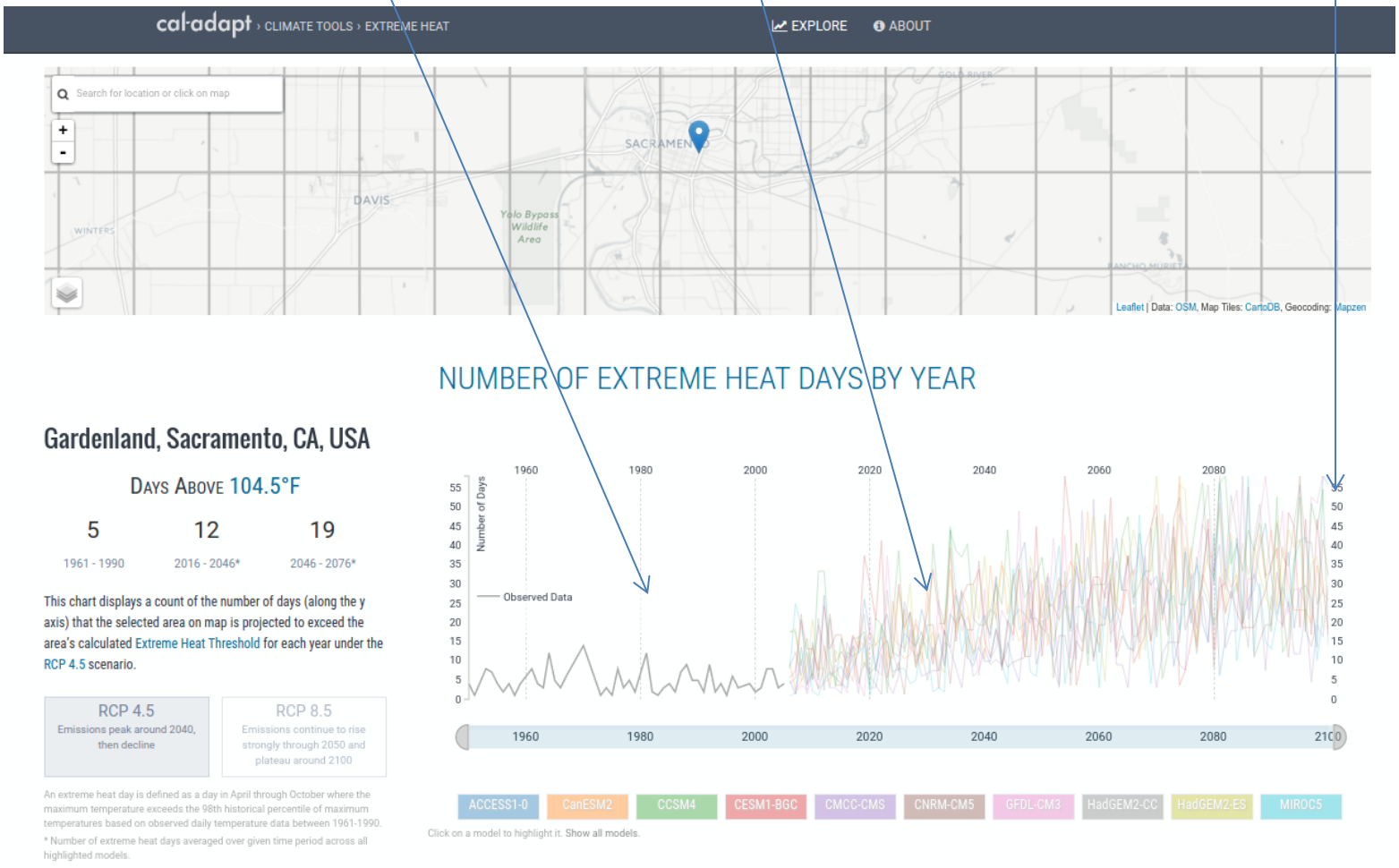
Projected Extreme Heat in Sacramento:

LOCA Results for RCP 4.5 (mid-policy scenario, peak emissions ca. 2040)

Historical data

Projected data

Scale: up to **55** days/year



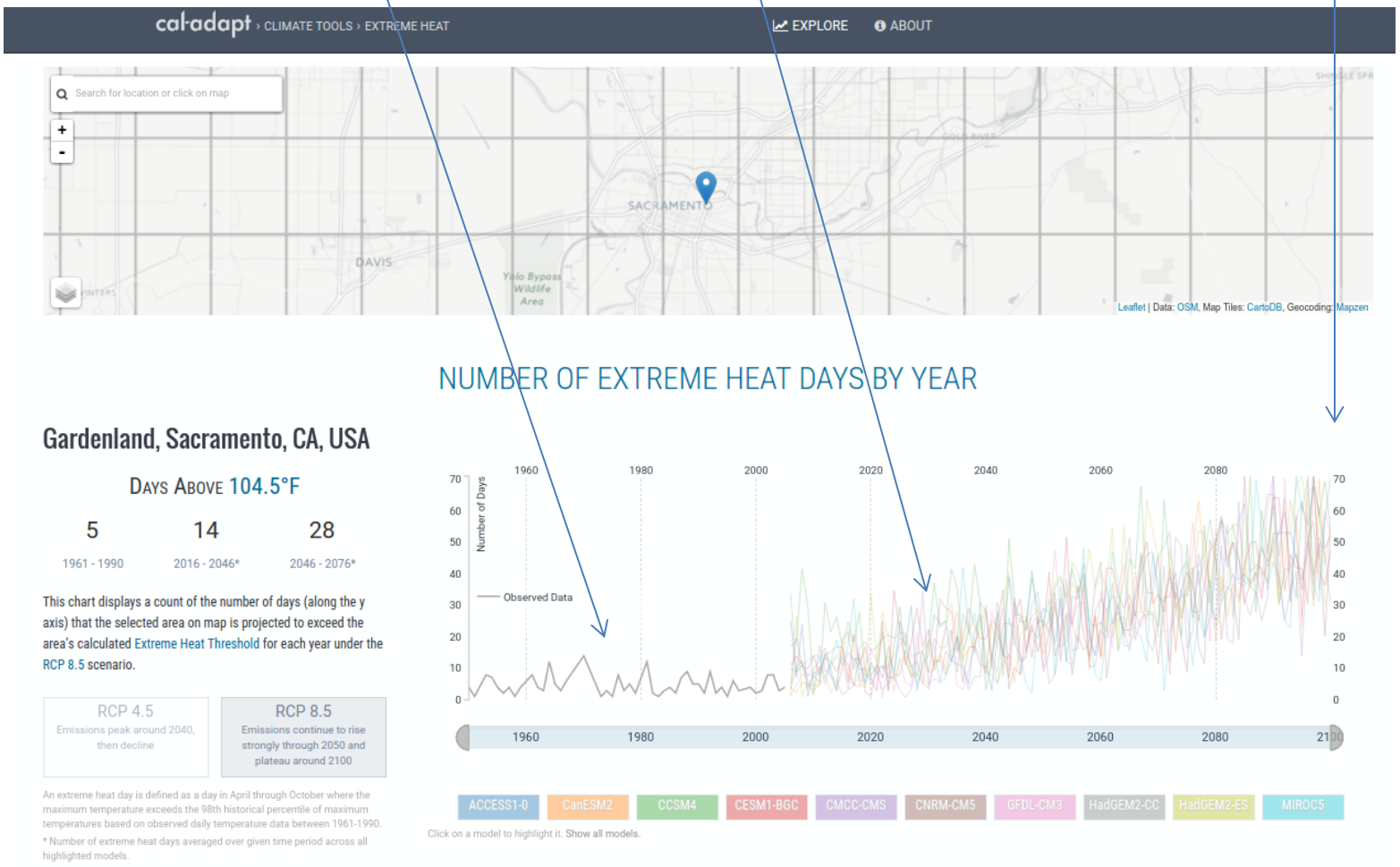
Projected Extreme Heat in Sacramento:

LOCA Results for RCP 8.5 (continued "BAU" growth at 2%/yr)

Historical data

Projected data

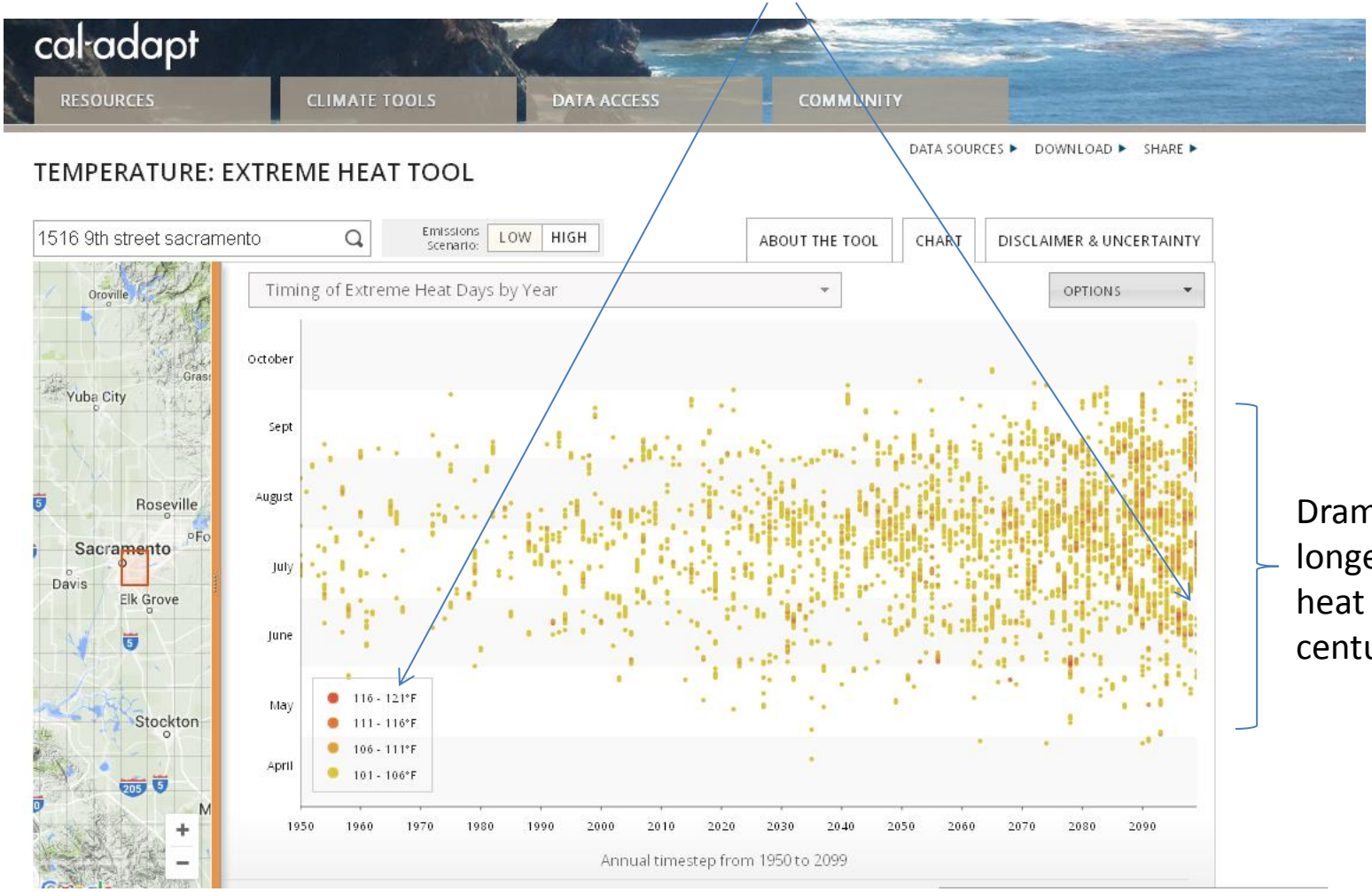
Scale: up to **70** days/year



Projected Extreme Heat in Sacramento:

W i d e r season, higher extremes

Toward latter part of century, unprecedented extremes as high as 116 to 121 degrees F projected



Dramatically longer extreme heat season by century's end.

Thank You!

Extreme heat tool for LOCA results will be available soon on the beta-site of Cal-Adapt 2.0:

http://beta.cal-adapt.org/

Please send your comments, questions, and tell us how you are using the data:

support@cal-adapt.org